SIR CHHOTU RAM INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

RENEWABLE ENERGY RESOURCES (BT-806)

NOTES ON ENERGY

ENERGY

- Energy is the capacity of a physical system to perform work. Energy exists in several forms such as heat, kinetic or mechanical energy, light, potential energy, electrical, or other forms.
- Energy is the capacity to do work. The word "Energy" has two parts. It comes from the Greek Words 'en' and 'ergon', en means in and ergon means work. Work means displacement of an object by the application of force.

TYPES OF ENERGY

1. Potential Energy :- Potential energy, or stored energy, is the ability of a system to do work due to its position or internal structure. For example, gravitational potential energy is a stored energy determined by an object's position in a gravitational field while *elastic potential energy* is the energy stored in a spring. It is also called stored energy. Batteries store chemical energy.

2. Kinetic Energy :- Kinetic energy is the energy of motion, observable as the movement of an object, particle, or set of particles. Any object in motion is using kinetic energy: a person walking, a thrown baseball, a crumb falling from a table, and a charged particle in an electric field are all examples of kinetic energy at work.

- **Kinetic energy** is the energy of motion.
- The energy of a body or a system with respect to the motion of the body or of the particles in the system.

Energy is further classified into the following types. Most of these energy can be converted from one form to another form.

- Mechanical Energy
- Chemical Energy
- Nuclear Energy
- Thermal Energy
- Electrical Energy
- Light Energy
- Sound Energy

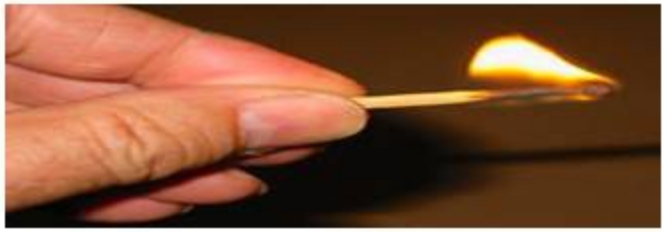
MECHANICAL ENERGY

- Mechanical Energy is the energy of work. When the heat or force energy is used to do work, we call it mechanical energy. The sum of the potential and kinetic energy of an object is the amount of its total mechanical.

A drawn bow possesses mechanical energy in the form of elastic potential energy.

CHEMICAL ENERGY

- Chemical energy is the energy contained in the internal structure of an atom or molecule.
- Chemical energy is a kind of potential energy stored in chemical bonds of compounds released during a chemical reaction. Fuels are good examples of chemical reaction. When they are burned, heat is released and can be converted into other forms as mechanical or electrical energy.
- The chemical bonds in a matchstick store energy that is transformed into thermal energy when the match is struck.



NUCLEAR ENERGY

- Nuclear energy is a source of power which is created from energy released by a nuclear reaction. Nuclear energy can be used to produce electricity.
- Nuclear energy is the energy in the nucleus of an atom. Atoms are the smallest particles that can break a material. At the core of each atom there are two types of particles (neutrons and protons) that are held together. Nuclear energy is the energy that holds neutrons and protons. This energy can be obtained in two ways: nuclear fusion and nuclear fission.

THERMAL ENERGY

- Thermal energy is the energy that is generated and measured by heat.
- The internal energy of a system in thermodynamics equilibrium due to its temperature.
- Heat being transferred from one thing to another. The rapidly moving molecules cause slower moving molecules to speed up. Running warm water over your cold hands would be an example.

ELECTRICAL ENERGY

- Energy made available by the flow of electric charge through a conductor.
- Electrical energy is energy that's stored in charged particles within an electric field.
- Electrical energy is also called as electromagnetic energy. Electrical energy is a type of wave energy and these energy-waves always move very quickly. When a bulb is switched on, it lights up instantly because the electrical energy moves so fast.

LIGHT ENERGY

- Light is defined as radiation that acts upon on the retina of the eye to make site possible.
- Light is a form of energy, which can be seen. It travels freely through space at a constant speed. The different colors of light are caused by vibration of light waves at different frequencies.

SOUND ENERGY

- Sound is generated due to the vibration of solids, liquids and gases. Depending upon the nature of vibrations, different frequencies are produced, of which only some range is audible.
- Sound energy moves through a process of vibrating air molecules, which create a chain reaction of vibrating molecules that the ear perceives as sound.

ENERGY CONSERVATION

- "Energy can neither be created nor destroyed but only converted from one form to the other". This is law of conservation of energy.
- The law of conservation of energy is a law of science that states that energy cannot be created or destroyed, but only changed from one form into another or transferred from one object to another.

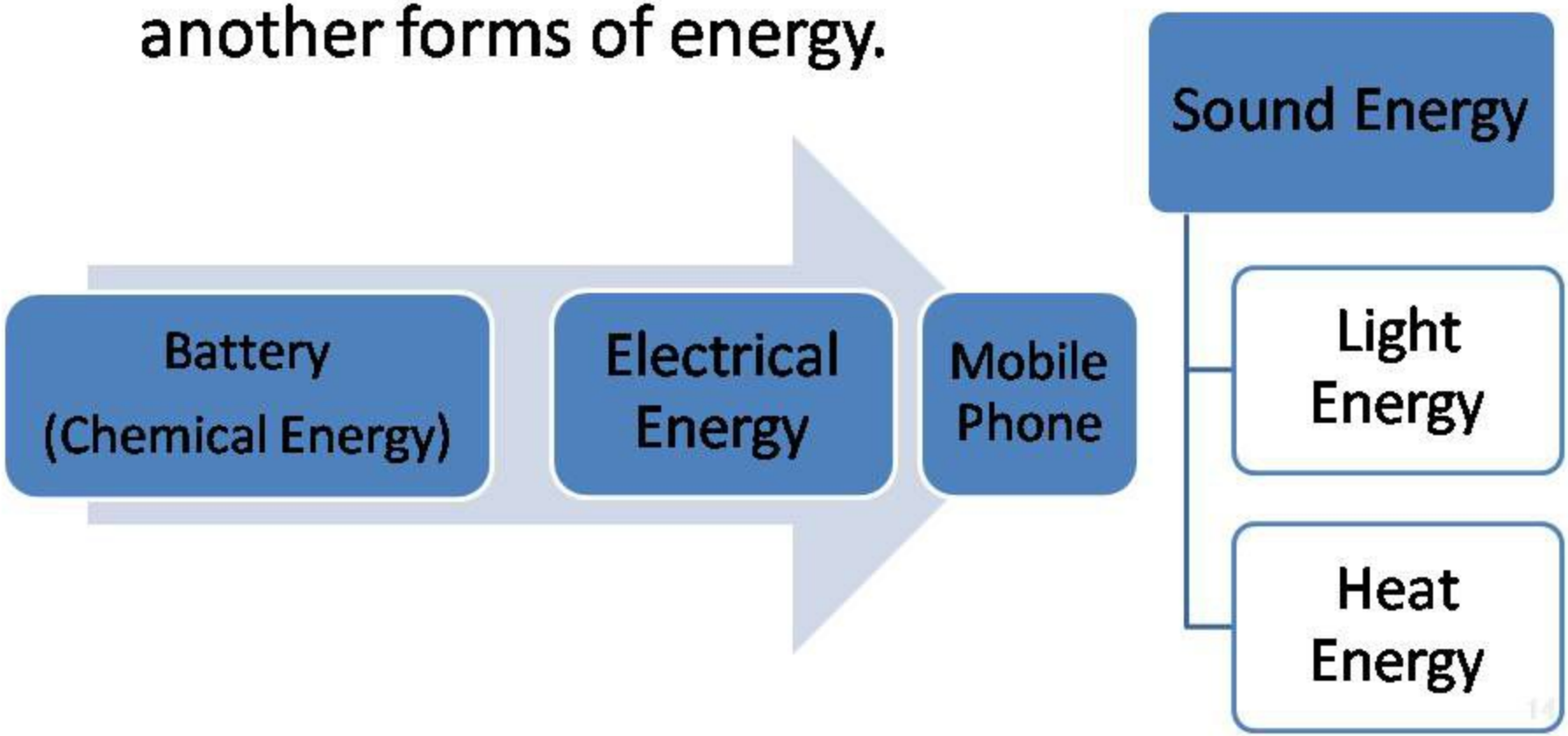
ENERGY CHAINS

- Energy chains are the forms of energy reactions where a change in form of energy to another causes other energy forms to change.

- Primary Examples :- Coal, Petroleum, Wind, Solar, Geothermal, Waves, Biofuels, etc
- Intermediate Energy :- Steam, Heat, Chemical Reactions, etc
- Secondary Energy :- Mechanical Power, Electricity, etc

ENERGY FLOW DIAGRAM

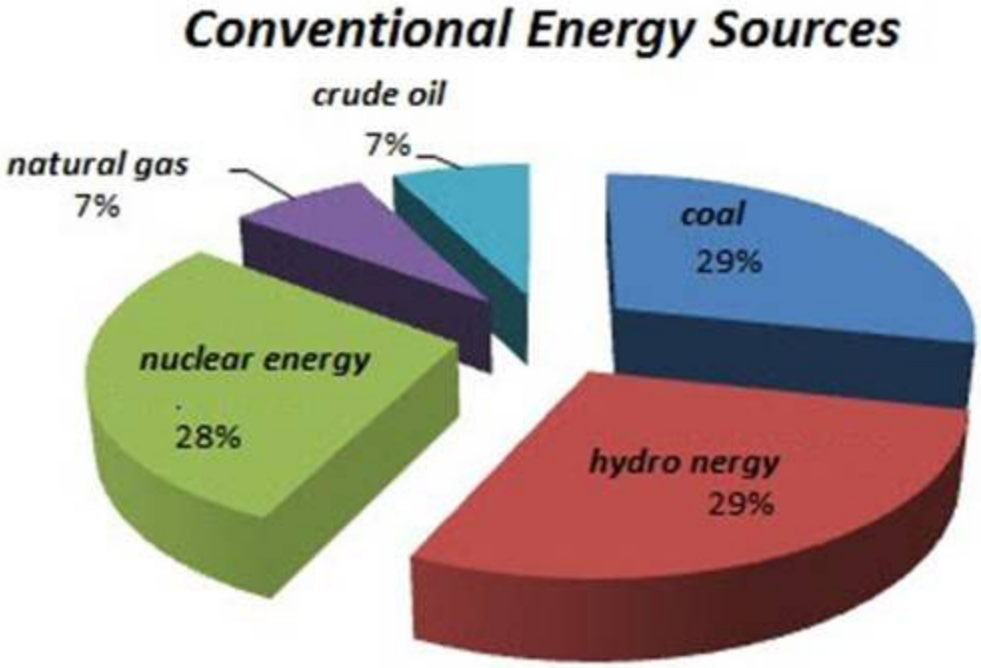
- Energy flow diagram illustrate how energy is transformed from one form of energy to another forms of energy.



ENERGY CLASSIFICATION

- Conventional Energy
- Non-Conventional Energy
- Renewable Energy
- Non-Renewable Energy

- Conventional Energy :- **Conventional energy**, such as thermal powers (from coal, petroleum, and natural gas), hydel power (from high velocity of running water).



- **Non-Conventional Energy :-** Non-conventional energy sources consist of those energy sources that are infinite, natural, and restorable. For example, tidal energy, solar energy, and wind energy are nonconventional sources of energy.
- Energy generated by using wind, tides, solar, geothermal heat, and biomass including farm and animal waste as well as human excreta is known as non-conventional energy.

HYDROPOWER ENERGY

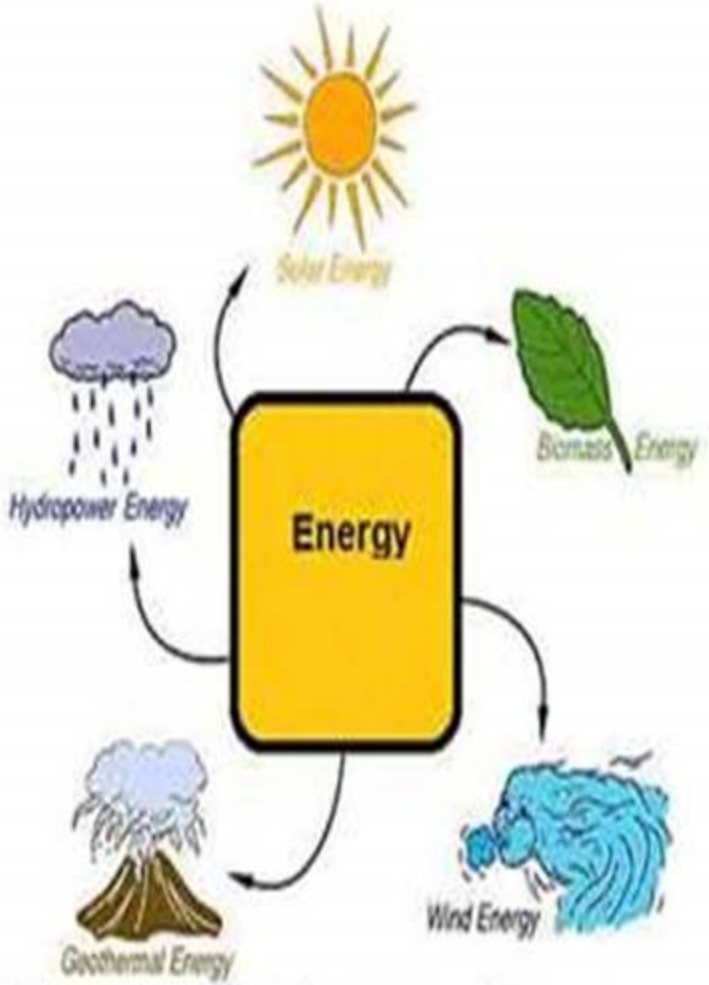
SOLAR ENERGY

BIOMASS ENERGY

GEOTHERMAL ENERGY

OCEAN ENERGY

WIND ENERGY



Non conventional sources of energy

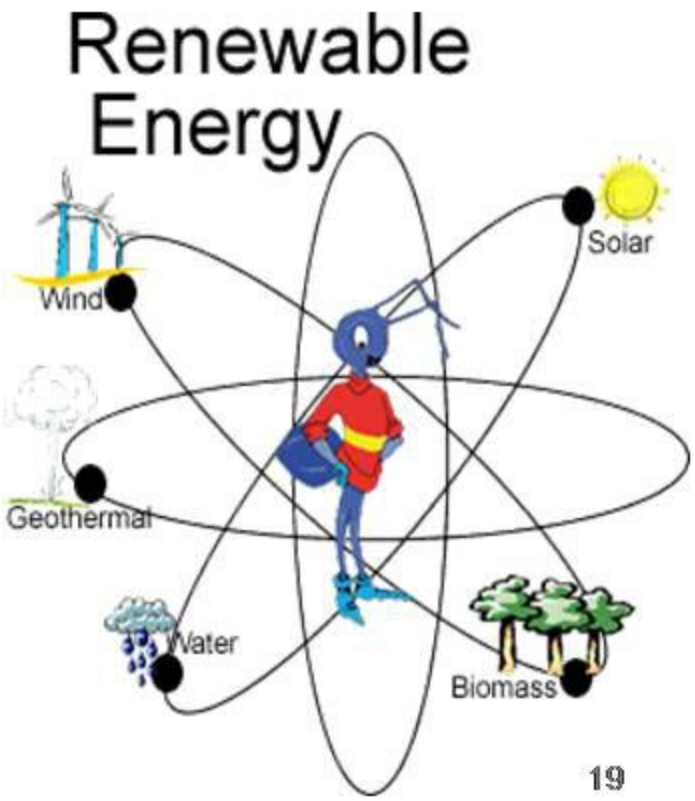
❖**Renewable Energy :-** Renewable energy is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which are renewable (naturally replenished). Renewable energy technologies

range from solar power,

wind power, hydroelectricity,

biomass and bio fuels for

transportation.

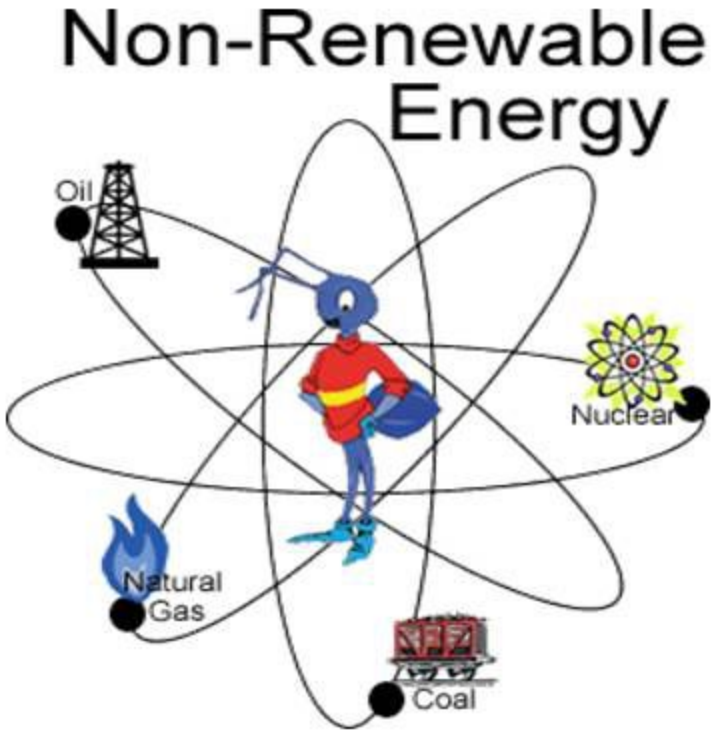


Renewable energy

Types of energy	Advantages	Disadvantages
Sun energy	Energy source is free; causes no pollution	Expensive; supply of sunlight can be interrupted
Wind energy	Energy source is free; causes no pollution	Only practical in areas with strong steady winds
Hydroelectric energy	Station cheap to operate; causes no pollution	Stations can only be built in certain locations
Geothermal energy	Energy source is free; causes no pollution	Only practical in a few locations
Biomass energy	The fuel tends to be cheap; less demand on the Earth's resources	By burning the fuel, it makes greenhouse gases

❖**Non-Renewable Energy :-** Non-renewable energy resource: an energy resource that is not replaced or is replaced only very slowly by natural processes.

Primary examples of non-renewable energy resources are the *fossil fuels*--oil, natural gas, and coal.



Non renewable energy

Types of energy	Advantages	Disadvantages
Fossil – fuel energy	Efficient, reliable	Limited supply of fuel in the world; waste of resources; pollution
Nuclear energy	Requires little fuel; produces little air pollution	Produces radioactive waste; stations expensive to build

FOSSIL FUELS

- Fossil fuels are hydrocarbons, primarily coal, fuel oil or natural gas, formed from the remains of dead plants and animals.
- Fuels such as coal, oil and natural gas were formed over millions of years from organic matter like plankton, plants and other life forms.
- Solid Fuels
- Liquid Fuels
- Gaseous Fuels